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SUMMARY OF SPORTSMEN'S EXPENDITURES, MISSOURI RIVER BASIN



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By

A. J. Nicholson, Fish and Wildlife Administrator

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United States Department of the Interior, Fred A. Seaton, Secretary

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The U. S. Fish and Wildlife Service and State agencies are concerned about the effects of Federal water development, such as those for irrigation and flood control, on the Nation's fish and wildlife resources. The effects of such developments are frequently expressed in monetary terms in order that benefits and losses may be appropriately assigned to a project. Since sport fish and game do not have a market value on which to base an evaluation, sportsmen's expenditures have been used as an indication of the value of these resources.

Because of a lack of specific studies on sportsmen's expenditures, fish and wildlife workers generally have had to rely on estimates of expenditures by sportsmen in hunting or fishing. Since most fish and wildlife workers hunt and fish, and thus have direct knowledge of applicable expenditures, these estimates have been fairly accurate. Nevertheless, after passage of the Coordination Act (the Act of August 14, 1946; 60 Stat. 1080; 16 U.S.C. 661; providing for studies of the effects on fish and wildlife resources of Federal and certain private water developments), specific studies of sportsmen's expenditures were considered necessary. The Office of Missouri River Basin Studies, Fish and Wildlife Service, conducted a series of expenditure surveys in the Missouri River Basin from 1948 to 1954. These surveys were for the purpose of determining the average daily expenditure of fishermen or hunters using specific areas, and this daily expenditure was then used to determine the expenditure per pound of fish, or unit of bird or animal bagged.

These surveys have been reported individually. Unfortunately, most of the reports were reproduced in mimeographed form and thus had a limited distribution. This publication is a brief summary of these reports and is designed to consolidate the major findings for the use of fish and wildlife workers and others interested in the problem of fish and wildlife evaluation. Variations in sportsmen's expenditures that occur from area to area and between species are shown in tabular form, and the important factors influencing the expenditures

are discussed. The List of References provide citations of original studies from which data in this paper were obtained. (Numbers used in the text for reference purposes are enclosed in brackets.)

Although the data used in this paper were obtained on only a limited number of areas in the Missouri River Basin, it is possible that they apply over a wide section of the country. At least, the information may serve as a more solid base for evaluations than has been obtained from the "educated guesses" used heretofore.

METHODS

Except for minor refinements made during the course of the studies, and except for the limited coverage of certain areas, similar methods were used for all studies. Methods, as illustrated by combination creel census and expenditure studies, are explained in some detail in Special Scientific Report, Fisheries Nos. 120 [20], 126 [21], and 141 [25], and, except for the broad considerations, the methods will not be repeated here.

The sportsman's daily expenditure was derived from the summation of four categories of expenses: (1) Transportation, (2) Trip, (3) Investment, and (4) Annual. Transportation expenses were determined by applying a rate of 7 cents to the average number of miles traveled per day by each person. The average number of miles per person per day was determined by dividing the round-trip mileage by the number of persons in the party and by the number of days in the trip. Trip expenses include expenditures for food, lodging, refreshments, fees for guide service or entrance to an area, rentals of horses, boats, bait or ammunition, and for miscellaneous items such as film and ice. These expenses were obtained from individuals on a daily basis. Investment expenses are those for equipment used in pursuit of a sport, which is prorated according to the life-expectancy and the number of days that the items are used per year. Fishing tackle, guns, decoys, dogs, boats, and special clothing were all taken into account in determining investment expenses. Annual expenses are recurring expenses, such as license fees, hunting and fishing magazine subscriptions, club dues, and contributions to conservation causes; all of which are prorated to the individual on the basis of the total number of days that the individual hunted or fished during the year of study.

All four types of expenditures were obtained in the field in the early studies (through 1949). In later studies, only transportation

and trip expenses were secured in the field; and other expenditures were applied either from a special survey of investment and annual expenditures of Montana sportsmen [8] or from surveys of similar nearby areas for which these expenses were obtained in the field. This procedure was adopted because of the extreme difficulty in obtaining investment and annual expenses in the field.

Except for the special study of Montana sportsmen, the studies were made in conjunction with creel censuses or bag checks. The daily expenditure figures derived from the field studies represent the expenditure for the average hunter or fisherman in the field rather than that for the average license holder. Derivations made from the special survey [8] were on the basis of the average license holder but were modified to that of the average sportsman in the field when used to complete the analysis of field studies.

In certain instances, expenditures were determined separately for nonlocal and rural-resident hunters. Nonlocal hunters include those individuals who used a car during the course of their hunt, whether from nearby or from some distant point. Rural-resident hunters are defined as those individuals who hunted on foot from their homes and therefore had no transportation or trip expenditures other than for ammunition.

Some calculations of expenditure per pound of fish or unit of game in the original references were based on rounded figures. For the purpose of this paper, all calculations were remade, using basic unrounded figures; therefore, some of the figures vary from those in the original reference.

In computing the average expenditures for warm-water and cold-water fishing in table 1, and for the average expenditures for pheasant, duck, deer, and elk hunting in table 2, allowance was made for the differences in sample sizes of the listed studies. This was accomplished by assigning to the figures from each study a weight equivalent to the number present in its sample, totaling these weighted figures, and dividing the total by the number in the combined samples to obtain general averages.

Analysis was made of the reliability of several aspects of some of the earlier studies; namely, Ocean Lake fishermen [2], Lake Maloney fishermen [4], Montana sportsmen [8], Fort Peck fishermen [10], and Yellowstone Unit hunters [12]. These analyses indicated a relatively high reliability. Later studies were not tested,

but the fact that the basic samples in the later studies were considerably greater than in the earlier listed studies would indicate that the later studies had a reliability at least equal to that of the earlier studies.

RESULTS

A total of 45 sportsman-expenditure studies have been made by the Fish and Wildlife Service in the Missouri River Basin. Of these, 10 were for warm-water fishing, 22 for cold-water fishing, 5 for pheasant hunting, 2 for duck hunting, 4 for deer hunting, 1 for elk hunting, and a special study of annual and investment expenditures of licensed sportsmen in 3 Montana counties.

The component parts of the sportsman's daily expenditure and the expenditure per pound of fish or unit of game are shown in tables 1 and 2 for each area studied. Daily expenditures for investment and annual items, as determined from the special survey in Yellowstone County, Montana, and in Valley and Roosevelt Counties, Montana, also are shown for each of the various types of fishermen or hunters.

Fisherman Expenditures

The total daily expenditure per fisherman varied considerably from area to area (see table 1). Factors that caused this variation include: location of the fishery in relation to centers of population, general accessibility, extent of participation by nonresidents, type of fishery, and extraordinary expenses such as guide or packing services.

Fisheries located close to a center of population receive a proportionately higher use by "local" fishermen than those located some distance away, simply because ardent fishermen will make repeated trips to a nearby area. Proportionately higher use by local people results in a lower average round-trip mileage and transportation expenditure. Local fishermen also have small expenditures for trip items. The above is illustrated by the low expenditures for transportation and trip categories by fishermen using Lake Maloney [4, 5] and the Middle Section of the West Gallatin River [7, 15]. These two fisheries were within 7 to 9 miles of North Platte, Nebr., (12,429 people), and Bozeman, Mont., (18,065 people), respectively, and received a high proportion of their use from these centers of population. Although the town of Fort Peck, Mont., had only 1,191 people (and thus cannot be

considered as a center of population), it is located at Fort Peck Dam within 2 miles of the main fishing waters [10] and frequent use by local residents had the effect of limiting the average daily expenditure for transportation and trip categories in much the same manner as at Lake Maloney and the West Gallatin River. The Cottonwood Lake Fishery [14] was located about 13 miles from Redfield, S. Dak. (2,428 people), which exerts the principal influence on the fishery. The relatively low expenditure for transportation and trip categories for the Republican River were due to the fact that the fishermen came from nearby; in fact, more than 95 percent of the fishermen using this fishery lived within a 50-mile radius.

Whether a fishery is accessible by a direct route rather than by a round-about-way also affects the mileage traveled. This is illustrated in part by the higher transportation expenditure determined for the Madison River below Madison Reservoir as compared to that for the river above the reservoir [21]. The lower section was much closer (airline distance) to the main area of influence (Butte, Mont.), but, because of the lack of a direct route, the driving distance was greater.

The proportion of nonresidents participating in a fishery affects the total daily expenditure. Even though a portion of their transportation and trip costs may be charged off to other purposes, such as visiting relatives or sightseeing, the nonresident's expenditures directly applicable to the fishery are considerably greater than for the resident and appreciably increase the average fisherman's daily expenditure where a number of nonresidents are involved. Transportation and trip expenditures at Ocean Lake [2, 3], the North Fork Sun River above Gibson Reservoir [20], Hebgen Reservoir [21], and the North Platte River [17] --all of which were patronized by many non-residents--reflect this situation. Between 14 and 59 percent of the fishermen using these fisheries were from out-of-state.

Nonresidents have higher license fees than residents, and frequently have more expensive equipment; thus it would be expected that expenditures listed in the investment and annual categories would be high in cases where nonresident usage was high. However, this limited study did not permit such a refinement in the figures for annual and investment expenditures shown in table 1.

Trip expenditures are generally lower than transportation expenses. In the two cases where trip expenditures took on a greater

significance than transportation expenditures--the North Fork Sun River above Gibson Reservoir [20] and the North Platte River [17] --extraordinary expenses for guide or packing services were involved.

The type of fishery--cold-water (trout) or warm-water--affects the daily expenditure. Warm-water fishermen use less specialized and less expensive equipment than cold-water fishermen. This is borne out by the studies conducted in the field and by the special survey of Montana fishermen. Another factor influencing investment expenditures is the number of days that each type of fisherman goes fishing. According to the Montana survey [8], warm-water fishermen go fishing more frequently than cold-water fishermen--16.4 days per year for warm-water fishermen as compared to 12.5 days for cold-water fishermen. The daily cost of investment items is proportionately lower for warm-water fishermen because of the greater use of his equipment.

In general, annual expenses constitute a relatively small part of the total daily expenditure and are about the same for both warm-water and cold-water fishermen.

Multiplication of the average daily expenditure by the total number of fisherman days, divided by the total yield in pounds, gives the expenditure per pound of fish.

Variations in the expenditure per pound of fish between the two types of fishing, the different areas, and the different years of study on areas where studies were for more than 1 year are attributable to one or more of three major factors: (1) the daily expenditure per fisherman, (2) the rate of catch, and (3) the average weight of the fish taken.

The expenditure per pound of fish at Ocean Lake during the summer of 1948 was almost double that for the summer of 1947, primarily because the average rate of catch in fish per hour of effort went down from 8.3 in the first season to 5.2 in the second season [2, 3]. The average weight of the fish taken (about 0.3 pounds per year) and the daily expenditure was about the same for each year of study.

The difference in the expenditure per pound of fish between 1949 and 1950 at Deerfield Reservoir was due primarily to a decrease in the average weight of fish taken, although there was a slight decline in the average rate of catch in 1950 [6]. The average

weight of trout declined from 0.60 pounds per fish in 1949 to 0.39 pounds per fish in 1950. The average rate of catch was 0.48 fish per hour of effort in 1949, and it was 0.42 in 1950.

The variation in expenditure per pound of fish between the Middle and Upper Sections of the Madison River [21] is attributable largely to the difference in the daily expenditure of the fishermen using these two stretches of stream, because the average weight of fish taken and the average rate of catch were quite similar on both areas. Fish taken in the two areas weighed 0.87 and 0.56 pounds respectively, and the average rate of catch was 0.62 fish per hour in the Middle Section and 0.55 fish in the Upper Section. The large daily expenditure for the Upper Section was due primarily to the large number of nonresidents who use the fishery. More than 55 percent of the fishermen using the Upper Section were nonresidents, as compared to 22 percent for the Middle Section.

The high average expenditure per pound of cold-water fish (\$5.13) as compared to that for warm-water fish (\$1.54) was due mostly to a generally lower average rate of catch and a higher daily expenditure for cold-water fishermen. The average daily expenditure for cold-water fishermen was \$7.38, as compared to \$3.72 for warm-water fishermen. The average rate of catch for the listed warm-water fisheries was more than two fish per hour while that for the listed cold-water fisheries was a little less than one-half fish per hour [25]. Although the average weight of cold-water fish was about 0.7 pounds, compared with about 0.5 pounds for warm-water fish [25], the slightly higher weight of the one type of fish was more than offset by the higher rate of catch for the other type.

The expenditure per surface acre of lakes or reservoirs, or per mile of stream, like the total expenditure on the area, varied considerably from area to area owing to differences in the daily expenditure and intensity of use. As already indicated, the daily expenditure is influenced by the type of fishery, manner of access, number of nonresidents, and other factors. Intensity of use also is influenced by a variety of factors, among which are the types of fishery, manner of access, number of pounds of fish per hour of effort, and size of lakes or reservoirs. All the influencing factors are so variable that detection of any general principles is virtually impossible, and the expenditure per acre of lake or reservoir or per mile of stream is presented only as a matter of interest. Because of the variables involved, the listed averages have no real meaning nor any general applicability. However,

the figures for the individual areas are indicative of the value of a particular area.

Hunter Expenditures

As in the case of fishermen, the daily expenditure of hunters varied considerably (see table 2). Important factors which caused these variations include the type of hunting, differences in the type and quantity of equipment used, method of determining investment expenses, and cost of the required hunting license.

The larger annual expenditure for duck hunters as compared to pheasant hunters was due mainly to the requirement for the \$2.00 Duck Stamp. The large annual expenditure for deer hunting in South Dakota reflects the requirement for a special \$7.50 license [22]. Annual expenditures of elk hunters were relatively high because of the \$5.00 license fee required for big-game hunting in Montana [23]. Variations in annual expenditures for pheasant or duck hunters can be attributed, in part, to differences in the cost of the small-game hunting license in the various States, and in part, to methods of calculation or to inclusion or exclusion of other annual expenses, such as club dues, magazine subscriptions, and contributions to conservation causes. Fees attributable to small-game hunting ^{1/} in the several States in which studies were conducted varied from \$1.00 in South Dakota [22], \$1.37 in Nebraska [24], \$1.50 in Montana [12], and to \$2.00 in Wyoming [19]. Annual expenses other than license fees were disregarded in the South Dakota and Nebraska studies.

Investment expenditures varied with the type of game because of differences in the equipment used and the number of times the equipment was used per year.

The slightly higher equipment expenditure for duck hunters using the Shoshone Unit [19], or for those who were contacted during the special survey in Montana [8], as compared to pheasant hunters from these same studies, can be attributed to the cost of rubber boots, decoys, boats, and other equipment, which is required by duck hunters, but which is not needed by pheasant hunters.

^{1/} One-half of any combination hunting and fishing license fee was arbitrarily attributed to small-game hunting and one-half of this amount was then arbitrarily attributed to pheasant hunting.

Elk hunters had a large investment expenditure because of the need for a variety of equipment and because of the small number of times such equipment was used each year. In addition to rather expensive rifles, these elk hunters used binoculars, camping equipment, and special clothing, which is not ordinarily required for small-game hunting. According to the Montana survey [8], elk hunters go hunting about 2 days each year, whereas duck and pheasant hunters go hunting a total of about 10 days each year; thus, it is obvious that investment expenditures for the average elk hunter, prorated on a daily basis, would be considerably greater than for the average pheasant or duck hunter. Investment expenditures of the South Dakota deer hunter [22] were small compared to that of Montana license holders [8] or the elk hunter [23], because these Missouri River bottom-land hunters used shotguns that also were used for small-game hunting. Since the South Dakota deer season was only 3 days long, and because the hunters came from a limited area (over 60 percent of the hunters came from within a radius of 25 miles), the expense of camping equipment was limited to a relatively few individuals.

Another factor that caused significant variations in investment expenditures was the method of determination. Even after adjustment to those for the hunter in the field, the investment expenditures obtained from the Montana license-holder study were larger than those determined in the field. The greater accuracy of the Montana study probably was the cause of this increase.

Trip and transportation expenses are affected by the type of hunting. The elk hunter, as an example, traveled a considerable distance [23] and had large associated trip expenditures. On the other hand, transportation and trip expenditures of deer hunters using the areas along the Missouri River were small because of the relatively short trip necessary to arrive at the chosen hunting area (radius of influence). From 60 to 80 percent of the deer hunters using the Missouri River unit areas came from within a radius of 25 miles [22]. Although there was some variation in the transportation and trip expenditure of duck and pheasant hunters using different areas, this difference was small generally, indicating a similarity in the radius of influence. Generally, the radius of influence was small, the majority of the hunters coming from within a radius of 25 miles. On the average, Nebraska pheasant hunters traveled a little further than pheasant hunters in other areas.

Ammunition costs, which are reflected by the trip expenditure for rural-resident hunters ^{2/}, showed minor variation from area to area. Some of this variation can be attributed to greater or lesser numbers of birds; some variation probably can be attributed to a difference in hunter ability.

The expenditure per unit of game was determined by dividing the daily expenditure by the take per day; consequently, the expenditure per unit of game varied from area to area with these two factors. Non-local pheasant hunters using the North Loup Unit [24] had the highest daily expenditure (\$5.58) of any group of pheasant hunters. This same group of hunters had both the largest (\$5.75) and one of the lowest (\$3.00) expenditure per bird, due to the difference in the rate of success in the 2 years of study. The rate of success in 1955 (1.9 pheasants per day) was almost double that of 1950 (1.0 pheasants per day). Republican Unit rural-resident hunters [24] had the highest expenditure per bird (\$3.02) of any of the rural-resident hunters, in spite of a low daily expenditure (\$1.38). These hunters had a success rate of less than one-half bird per day.

Nonlocal duck hunters using the Shoshone Unit [19] had a smaller expenditure per duck than Yellowstone Unit hunters [12] because they killed nearly twice as many ducks per day.

Deer hunters took about 0.2 of a deer per day [1, 22] and the elk hunters took only 0.05 elk per day [23]. These low rates of success coupled with the relatively high daily expenditures for these hunters resulted in an expenditure of more than \$30.00 per deer and more than \$250.00 per elk.

The total expenditure on each area and the hunter's average expenditure per section are shown only as a matter of interest. As in the case of similar fisherman expenditures, these figures have little real meaning or general applicability because of the many factors involved. As in the case for fishing, the expenditure per section for hunting is influenced by the daily expenditure and the intensity of use. Factors involved in the daily expenditure have already been set forth. Intensity of use is influenced by access, rate of success or initial

^{2/} Only ammunition costs were used in trip expenditures of rural-resident hunters.

population of the species sought, and general availability of the species sought in other parts of the State concerned.

DISCUSSION AND SUMMARY

A total of 45 sportsman-expenditure studies were conducted in the Missouri River Basin during 1947 to 1954. Of these, 10 were for warm-water fishing, 22 for cold-water fishing, 5 for pheasant hunting, 2 for duck hunting, 4 for deer hunting, 1 for elk hunting, and 1 special study of annual and investment expenditures of licensed sportsmen in 3 Montana counties. The component parts of the total daily expenditure--expenses for Transportation, Trip, Investment, and Annual or recurring items--of the various types of sportsmen, and the calculated cost per pound of fish or unit of game, are shown for each study area.

Of the component parts of the sportsman's total daily expenditure, transportation expenses were generally of greatest significance--generally about 50 percent. In a few instances, where extraordinary expenses for guide or packing services for fishermen were involved, trip expenses were about 50 percent of the total. Requirement of a special \$7.50 license to hunt deer in South Dakota resulted in the annual expense being about 50 percent of the daily expenditure. In the one elk-hunter study, transportation and investment expenditures were nearly equal, and, together, comprised about two-thirds of the total daily expenditure.

The sportsman's daily expenditure varied with the species of game or the group of fishes sought. On the average, cold-water (trout) fishermen spent nearly twice as much per day as warm-water fishermen. Of the hunters, pheasant hunters spent the least amount per day. In comparison to the pheasant hunter, the average duck hunter spent 1.5 times as much per day, the deer hunter 2.5 times as much, and the elk hunter 4 times as much. The daily expenditure of the various types of hunters or fishermen varied from area to area due to variations in the component parts of the total.

The expenditure per pound of fish or unit of game varied with the daily expenditure, the rate of success, and other factors. On the average, the cost per pound of cold-water fish was more than three times as great as the cost per pound of warm-water fish. In comparison to a pheasant, a duck cost nearly 2 times as much, a deer 11 times as much, and an elk 84 times as much.

The total expenditure on each study area, and the average expenditure per surface acre of lakes or reservoirs, or per mile of stream for fishing, and the expenditure per section for hunting are shown, even though such figures have little real meaning or general applicability. Total expenditures and expenditures per surface acre, per mile of stream, or per section of land for individual areas reflect the value of the particular areas.

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